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6. "Researches on the Arseniates, Phosphates, and Modifications of Phosphoric Acid." By Thomas Graham, Esq., M.A., F.R.S.E., Lecturer on Chemistry in the Andersonian Institution at Glasgow. Communicated by Dr. Turner, F.R.S.

This paper, which forms the sequel to the one on the same subject which was read at the preceding meeting, continues the inquiry into the combinations of phosphoric acid with different bases, and more particularly with soda. The crystallized salt of phosphate of soda was found to contain 37.1 of the phosphate, and 62.9 of water; so that the author infers its composition to be three atoms base, namely, two of soda and one of water. The pyrophosphate of soda, on the other hand, contains only two atoms soda as base, and gives accordingly bibasic precipitates. The biphosphate of soda was found to admit of so great a number of changes in its composition and properties, as to render it an object of great interest. Of the four atoms of water which the crystals contain, they lose two atoms at the temperature of 212° , and not a particle more till the heat is raised to about 375° . There is every reason to believe that the two atoms of water retained are essential to the constitution of the biphosphate of soda; and that it contains three atoms of base, namely, one atom soda to two atoms water, united to a double atom of phosphoric acid. Other varieties of this salt are also met with; the first of which may be called a bi-pyrophosphate, containing only one atom of basic water; the second being anhydrous, though soluble in water, and neutral in its reaction on litmus, but of which the exact composition is not well determined; the third being an insoluble variety; and a fourth being a metaphosphate of soda,—the author designating, by the term Metaphosphoric acid, a peculiar hypothetical state of composition of the elements of phosphoric acid in conjunction with water. This new acid enters into combination with barytes and with lime, forming with these bases other metaphosphates. The author concludes by a general review of the several modifications of phosphoric acid which have resulted from these inquiries.

7. "On the Development of the Disturbing Function upon which depend the Inequalities of the Motions of the Planets, caused by their Mutual Attraction." By James Ivory, Esq., K.H., M.A., F.R.S.

The progress of physical astronomy has been retarded by the excessive labour requisite for the arithmetical computation of the inequalities in the motions of the planets, arising from the perturbations produced by their mutual attractions. If an inequality depended solely on the quantity of the coefficient of its argument in the expanded algebraic function, the difficulty of computation would not be great, since, from the smallness of the elements on which it depends, namely, the eccentricities and the inclinations of the orbits to the ecliptic, the resulting series decreases, in every case, with great rapidity: but as its magnitude depends also upon the length of its period, the coefficient of its argument will, when this period embraces many years, acquire, in the process of integration, a high multiplier, and comes thus to have a sensible effect on the place of the planet.

Such is the origin of some of the most remarkable of the planetary inequalities, and, in particular, of the great equations in the mean motions of Jupiter and Saturn. It is necessary, therefore, that the astronomer be furnished with the means of computing any term in the expansion of the disturbing function below the sixth order; since it has been found that there are inequalities depending upon terms of the fifth order, which have a sensible effect on the motions of some of the planets. The object of the author in the present paper is to give the function such a form that the astronomer may have it in his power to select any inequality he may wish to examine, and to compute the coefficient of its argument by an arithmetical process of moderate length. The investigation comprehends every argument not passing the fifth order; but as the formulæ are regular, the method may be extended indefinitely to any order.

8. "On the Reflex Function of the Medulla Oblongata and Spinalis, or the principle of Tone in the Muscular System." By Marshall Hall, M.D., F.R.S. L. & E.

The author, after commenting on the opinions of Le Gallois and Cruveilhier relating to the functions of the spinal marrow, adverts to a property or function of the medulla oblongata and spinalis, which he considers as having escaped the notice of these and all other physiologists; namely, that by which an impression made upon the extremities of certain nerves is conveyed to these two portions of the nervous system, and reflected along other nerves to parts different from those which received the impression. He distinguishes muscular actions into three kinds: first, those directly consequent on volition; secondly, those which are involuntary, and dependent on simple irritability; and thirdly, those resulting from the reflex action above described, and which include those of the sphincter muscles, the tonic condition of the muscles in general, the acts of deglutition, of respiration, and many motions, which, under other circumstances, are under the guidance of the will. Volition ceases when the head or brain is removed; yet, as he shows by various experiments, movements may be then excited in the muscles of the limbs and trunk, by irritations applied to the extremities of the nerves which remain in communication with the spinal marrow: but these actions cease as soon as the spinal marrow is destroyed. Hence the author concludes that they are the effect of the reflex action of the spinal marrow, which exists independently of the brain; and, indeed, exists in each part of the organ independently of every other part. He considers that this reflex function is capable of exaltation by certain agents, such as opium and strychnine, which in frogs produce a tetanic and highly excitable state of muscular irritability. Hence he is led to view the reflex function as the principle of tone in the muscular system. He considers that certain poisons, such as the hydrocyanic acid, act by destroying this particular function. The effects of dentition, of alvine irritation, and of hydrophobia, of sneezing, coughing, vomiting, tenesmus, &c. &c., are adduced as exemplifications of the operation of the same principle when in a morbid state of exaltation.